

Phase I Project Summary

Firm: Intelligent Automation, Inc.

Contract Number: NNX11CD13P

Project Title: The Design and Optimization of an Integrated Arrival / Departure Scheduler

Identification and Significance of Innovation: (Limit 200 words or 2,000 characters whichever is less)

The product is a set of mathematical equations which, when fed with actual schedule data from airports, will produce a better schedule that is operationally more efficient. Tests done during the Phase I work suggest that improvements of efficiency up to a factor of two can be obtained. This product differs from others that have similar goals in that this product reschedules both arrivals and departures simultaneously, whereas existing products reschedule only departures and leave arrivals as fixed.

Technical Objectives and Work Plan: (Limit 200 words or 2,000 characters whichever is less)

Technical Objective 1. Development of a control algorithm that allocates flights to available arrival and departure slots. The control algorithm needs to integrate the arrival and departure situation, so that intelligent decisions can be made to minimize flight delay, maximize airport throughput, and maximize the quality of service perceived by all flights.

Technical Objective 2. Design a simplified testbed to understand the limitations of the algorithm. The simplified testbed will consist of a simple software system that provides arrival and departure flights to the control algorithm, and, using the scheduling information provided by the control algorithm, estimates the resulting flight delays.

Technical Objective 3. Using the testbed, the control algorithm will be evaluated under different traffic and weather scenarios, with recommendations for enhancements or changes to the algorithm made as a result of the tests.

The research tasks associated with this proposed work are as follows:

1. Develop scenarios and a simplified testbed for the control algorithm.
2. Develop the control algorithm.
3. Design a sophisticated testbed for later (phase II) experimentation.
4. Run experiments with the control algorithm to assess its feasibility.
5. Reports and documentation.
6. Develop Phase II and transition plans.

Technical Accomplishments: (Limit 200 words or 2,000 characters whichever is less)

We developed four different schedulers:

1. A scheduler for departures only, to validate against existing tools.
2. A scheduler that optimizes arrivals first, and after that then interleaves the departures in the fixed arrival stream.
3. A scheduler that simultaneously optimizes arrivals and departures by moving the position of aircraft in the arrival or departure stream.
4. A scheduler that simultaneously optimizes arrivals and departures by moving the time that the aircraft occupy the arrival or departure stream.

These four schedulers were tested on actual data from San Diego International Airport, and the results show that a combined arrival/departure scheduler can improve the efficiency of airport operations by up to a factor of two compared to either one alone.

NASA Application(s): (Limit 100 words or 1,000 characters whichever is less)

The ultimate application of this tool is to improve the efficiency of airport operations by considering both arrivals and departures when performing schedule evaluation. As a research tool, NASA researchers can use it to experiment with different policies for airport scheduling.

Non-NASA Commercial Application(s): (Limit 200 words or 2,000 characters whichever is less)

The Federal Aviation Administration as well as large airports can use this tool to improve operational efficiency of airports without adding expensive new infrastructure, such as runways, or investing in advanced procedures, such as new approaches, that require expensive avionics.

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